Unit of Study: Unit Conversion, Cell Structure, Forces, Measurement Skills
Classroom: Middle School/High School
Number of Students:
Grade Level:

1. **TEACHER’S OBJECTIVE(S) FOR THE CLASS:**
   - **Major Curricular Concept:**
     - Biology
     - Cell Structure
     - Physics/Middle School Science
     - Forces, Properties of Matter
     - Chemistry
     - Chemical Properties
   - **STEM Applications**
   - **Common Core or Standards’ Reference(s)**
     - CT Science Standards
     - Inquiry Based Learning
     - RST Standards for Summarizing Key Ideas, from Reading Articles on Wood Types & Uses of Wood for Various Functions

What students will know/understand and be able to do as a result of the lesson:
- **Biology** - The structure & function of plant cells & taxonomy of tree samples.
- **Chemistry** - How does the chemical composition affect density. **Physics** - Regular & Irregular Volumes/Strength

2. **CLASS ACTIVITY:** (Include planned instructional strategies to facilitate student learning):
   - Provide samples of 4 types of wood of various sizes & shapes. Present a problem to investigate & have them design experiments based on their interest. This can be Biology, Chemistry, or Physical Science.

3. **MATERIALS:** (What is required to perform the activity?)
   - Masses, Water, Rulers (Both Metric & Inches), Beakers, Microscope, Appropriate Chemicals
4. **OTHER FACTORS:** Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

This activity lends itself to differentiated instruction. Presentation, collaboration, & math skills are being utilized & observed.

5. **OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:**

6. **OTHER COMMENTS:** (Regarding Expected Outcome)

These questions should lead to more questions that students may want to investigate.

- What wood do they use to build houses in Northern CT vs seashore? Why TREX versus wood? What type of wood do they use for boats, etc?

7. **HOW WILL STUDENT SUCCESS BE MEASURED?**

Rubric based Lab Report given to teacher. Assessment is ongoing because the teacher will be walking around to monitor the progress of each station. The teacher will give help when needed. There also be an Exit Slip to answer important concepts.
Physics

Biology

Phy. Science

Math

\[ x = \text{diameter of circular object} \]
\[ y = \text{circumference of circular object} \]

\[ x \] (or I.V.)

sentence model

As [IV] from \# to \#
(changes, increases, decreases)

[DV] (changes, increases, decreases)

linear equation

\[ y = mx + b \]

1) generate quantitative data
2) plot x-y data points on an x-y scatter plot.
3) summarize your data w/a sentence
4) use the linear equation to make a prediction.
5) summarize your prediction in a sentence.
6) write a procedure to test your prediction.
7) test your prediction.
8) repeat steps #2-3 & draw conclusions.

Physical Science - \[ \text{Ice} \rightarrow \text{temp rises} \]

\[ \text{time} (x) \]

\[ \text{boils} \]

\[ \text{temp} (y) \]
As I. v.

From 0 to #

Changes: decreases

Decreases: decreases

Changes: increases

D. V.

While

y = mx + b

x (or I. v.)
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Generic Lesson Plan

Unit of Study: Physical Science

Classroom:

Number of Students: 25

Grade Level: 9

1. TEACHER’S OBJECTIVE(S) FOR THE CLASS:
   - Major Curricular Concept: phase changes (in water)
   - STEM Applications: generating quantitative data, interpretation of graphs, drawing conclusions, changes in temperature and movement of molecules
   - Common Core or Standards’ Reference(s): translation of quantitative data, evaluate hypothesis, draw conclusion, G. SP.1,2 construct and interpret scatter plots.

   What students will know/understand and be able to do as a result of the lesson:

   Students will collect data, graph it, evaluate hypothesis, will relate changes in temperature to changes into molecular forces & bonds

2. CLASS ACTIVITY: (Include planned instructional strategies to facilitate student learning):
   1. Generate quantitative data.
   2. Plot x-y data points on an x-y scatter plot.
   3. Summarize your data w/ a sentence.
   4. Use linear equation to make a prediction.
   5. Summarize your prediction in a sentence.
   6. Write a procedure to test your prediction.
   7. Test your prediction.
   8. Repeat steps # 1-4 to draw conclusions.

3. MATERIALS: (What is required to perform the activity?)
   - beakers
   - water
   - hot plate
   - safety glasses
   - graph paper
   - rulers
   - thermometer
4. OTHER FACTORS: Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

1) Expect students will predict that time + temperature will always increase.

2) Through experimentation, student will discover that temperature will not increase too pass 100°C.

5. OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:

Sentence model:

\[
\text{AS} \quad \frac{\text{IV}}{\text{DV}} \quad \text{(changes, increases, decreases)} \quad \text{from} \quad \# \quad \text{to} \quad \# \\
\]

6. OTHER COMMENTS: (Regarding Expected Outcome)

This lesson can be modified to include other subjects. For example in math class, students can collect data through measurement (diameter of can, circumference of circle).

7. HOW WILL STUDENT SUCCESS BE MEASURED?

Students will perform experiment recording data. Students will plot the graph.
1. **TEACHER’S OBJECTIVE(S) FOR THE CLASS:**

   - **Major Curricular Concept:** properties of materials

   - **STEM Applications**
     
     to replace anatomical structures with an artificial structure.

   - **Common Core or Standards’ Reference(s)**
     
     PS1. A: Structure + Properties of Matter

   What students will know/understand and be able to do as a result of the lesson:

   - analyse + determine the best material for limb-replacement (specifically a long-bone: femur)

2. **CLASS ACTIVITY:** (Include planned instructional strategies to facilitate student learning):

   Students will test a variety of materials (metals) in solutions of different pH’s.

   Students will conduct research to assist in making their determination.

3. **MATERIALS:** (What is required to perform the activity?)

   - metal samples
   - test tube holder
   - test tubes
   - copper sulfate solution
   - water
4. OTHER FACTORS: Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

The students will have prior exposure to and comprehension of pH and concentration of acid(s). Students will have prior exposure and comprehension of the periodic table.

5. OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:

SWBAT determine the best material to artificially replace a long bone (femur) in the human body.

SWBAT defend their answer using information determined by experimentation and research.

6. OTHER COMMENTS: (Regarding Expected Outcome)

Extensive - students could rate their choices using different materials and use their research/data to defend their answers.

7. HOW WILL STUDENT SUCCESS BE MEASURED?

- Students will create a poster/powerpoint/etc. and present their findings to their peers.
  (with a rubric)
- A self-reflection piece "What would they use and why?"
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Generic Lesson Plan

Unit of Study: It's a Slippery Slope: Can we make an environmentally-friendly boat hull paint?

Classroom: Science

Number of Students:

Grade Level: 6-12

1. TEACHER'S OBJECTIVE(S) FOR THE CLASS:

   Key Question: Slopes must prevent the attachment of barnacles; however, the paints currently used harm the ocean ecosystem. Can a safe paint be developed?
   - Major Curricular Concept:

   - STEM Applications
     Core Idea PS1: Matter and Its Interactions
     PS1.B: Chemical Reactions

   - Common Core or Standards' Reference(s)
     Reading Standards for Literacy in Science and Technical Subjects 6-12
     6-8 #1. Cite specific textual evidence to support analysis of science and technical texts.
     9-10 #3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
     11-12 #9. Synthesize information from a range of sources... into a coherent understanding...
     What students will know/understand and be able to do as a result of the lesson:

     * Anti-fouling of boat hulls is a goal to prevent the boat from barnacle growth.
     * The elements to create paint that have an anti-fouling effect can have a negative environmental impact (copper)

2. CLASS ACTIVITY: (Include planned instructional strategies to facilitate student learning):

   Experiment with copper to see bacteria growth on surface.

3. MATERIALS: (What is required to perform the activity?)

   □ Copper Association reference materials — bacterial growth on metal surface
     Development (copper alloy peels being given to doctors)
4. **OTHER FACTORS:** Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

Students will be asked to understand the concept of "anti-fouling" paint for ship hulls to prevent "accidental tourists"/barnacle growth.
- What happens to oyster beds when boats pass over them?
- What are the caustic elements in paint?
- What are the components in marine paint? In what proportion?
- What are the pros/cons of current paint compositions?
- How long does the paint last (effectively protect hull)?
- How does water salinity react with paint?
- What is hydrospace engineering?
- The elements that comprise paint — pick one and trace where that element exists in your everyday life?

5. **OBSERVATION NOTES REGARDING OBJECTIVE(S) and EXPECTED OUTCOME:**

This unit will be differentiated by:
1) Offering a pre-test to determine prior student knowledge of elements/paint/marine ecology + technology interaction
2) Student who show advanced knowledge or ability will have an enrichment option to go in-depth in their choice of aspect of the unit
3) Struggling students will receive ready-made materials at their level/simpler version/ hands-on experiments.

6. **OTHER COMMENTS:** (Regarding Expected Outcome)

7. **HOW WILL STUDENT SUCCESS BE MEASURED?**

* Students will present on the pros/cons of current hull paint
* Students will present on the elements that compose paint
* Students will make a product that selects one element from paint
* Students will make a product that selects one element from paint and show the role of that element in their everyday life
* Students will research alternative revoke ideas for hull-protecting paint
1. **TEACHER’S OBJECTIVE(S) FOR THE CLASS:**

   - **Major Curricular Concept:** Gas production by microorganisms (video)
   - **STEM Applications:** Chabaso Bread Co. manufacturing, problem solving in manufacturing
   - **Common Core or Standards’ Reference (s)**

   *How can we get the biggest % rise?*

2. **CLASS ACTIVITY:** (Include planned instructional strategies to facilitate student learning):

   1. Build background knowledge on bread making and yeast fermentation process.
   2. Research best bread making ratios.
   3. Day 1 Trials: figure ratios process overnight.
   4. Share best % T Day 2: use information to decide Day 2 Trial ratios w/ 3 trials.

3. **MATERIALS:** (What is required to perform the activity?)

   - Flour
   - Yeast
   - Water
   - Thermometer
   - Straw created box to dimensions (e.g., 2x3x26cm)
   - 200 mL beakers (or other tubes)
   - Conclusion
4. OTHER FACTORS: Is there anything special that is needed to know about the students, room, recent events, technology, expected outcome, etc.

5. OBSERVATION NOTES REGARDING OBJECTIVE(S) AND EXPECTED OUTCOME:

6. OTHER COMMENTS: (Regarding Expected Outcome)

7. HOW WILL STUDENT SUCCESS BE MEASURED?

Did control all variables?
exper. validity
conclusion & reasonable recommendation
to Chabaso Bread Co using exp. data.
Lesson Plan Questions to Consider

1) Which experience in this institute interested you the most?
   - materials - how to make them stronger
2) Which experience provided information/insight/knowledge that intrigued you the most?
   - drilling metals - blue hot - how to do it right
   - breaking drill
3) Which experience supplied you with new and novel information?
   - visiting the sites
4) Which experience do you think would impress your students the most?
   - hands-on learning
5) Which experience best portrayed what STEM involves?
   - employers talking about math skills and creative problem solvers
6) Which experience(s) do you wish to bring back to your classroom?
   - applied science
7) Why? It gives a purpose to learning science
8) How would you structure an effective lesson around this experience?
   - relating what their learning has to do with the real world
9) What would the objective of this lesson be?
   - inviting people from people from
   - learn about osmosis/what is moving in and out manufacturing to speak
10) Would this be an experiential learning activity?
    - yes
11) How will you use all of the elements of STEM in this lesson?
    - students will measure, weigh - look up molecule size, pore size of
12) Which elements would you stress?
    - membranes -
    - you learned this by yourself
13) Will this be a singular lesson or be delivered over a number of days?
    - perhaps a few days of thought
14) What result(s) would you be seeking?
    - students realize that what solution you put an
    - egg in will influence the size of the egg
15) How will you ensure that all of your students are participating?
    - talk to them
16) How would you measure the result(s) and/or the effectiveness of the lesson?
    - students would keep data -
    - give an explanation for your observations

A Slippery Soup